Claims

1. A bioactive artificial sintered composition for providing a morphology capable of consistently supporting bone cell activity thereon, said composition comprising stabilized calcium phosphate phases developed by the conversion of a hydroxyapatite substance in the presence of stabilizing entities at sintering temperatures into insolubilized and stabilized tricalcium phosphate.

2. A composition as claimed in claim 1, wherein said stabilized tricalcium phosphate is primarily alpha tricalcium phosphate.

3. A composition as claimed in claim 2, wherein said composition is in the form of a powder, film, thick coating or a three-dimensional bulk material.

4. A composition as claimed in claim 3, wherein said film has a thickness of about 0.1 μm to 10 μm.

5. A composition as claimed in claim 3, wherein said hydroxyapatite substance before sintering is provided on a substrate comprising a component selected from the group consisting of silicon entities, aluminum entities, zirconium entities, barium entities, titanium entities and mixtures thereof.

6. A composition as claimed in claim 5, wherein said stabilizing entities are released from said substrate during sintering or added in solution to the hydroxyapatite substance before sintering.

7. A composition as claimed in claim 3, ~~5, or 6~~, wherein said stabilizing entities are selected from the group consisting of silicon, germanium, chromium, vanadium, niobium, titanium, boron, aluminum, zirconium and mixtures thereof.

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8. A composition as claimed in claim 2, wherein said composition is coated onto a quartz substrate, silicon entities being released from the quartz upon sintering, into the forming calcium phosphate phases to stabilize the alpha tricalcium phosphate.

9. A composition as claimed in claim 3, wherein said silicon entities are added in solution to the hydroxyapatite substance before sintering.

10. A composition as claimed in claim 1 ~~or claim 9,~~ wherein said silicon entities are tetrapropyl orthosilicate.

11. A composition as claimed in claim 1, wherein said calcium phosphate phases are in a ratio of 50:50 to 20:80 for hydroxyapatite to alpha tricalcium phosphate.

12. A composition as claimed in claim 1, wherein said composition is insoluble in physiological fluids of pH of approximately 6.4 to 7.3.

13. A process for stabilizing an artificial sintered composition of calcium phosphate phases having a morphology suitable for supporting bone cell activity thereon, said process comprising converting a hydroxyapatite substance, into primarily alpha tricalcium phosphate by sintering, and providing stabilizing entities which stabilize and insolubilize the formed alpha tricalcium phosphate within the phosphate phases.

14. A process as claimed in claim 13, wherein the composition formed is a powder, film, coating or a three-dimensional solid.

15. A process as claimed in claim 14, wherein said hydroxyapatite substance is applied onto a substrate comprising a component selected from the group consisting of silicon entities, aluminum entities, zirconium entities, titanium entities, boron entities, germanium

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entities, chromium entities, vanadium entities, niobium entities and mixtures thereof.

16. A process as claimed in claim 15, wherein said stabilizing entities are released from said substrate into the hydroxyapatite phases developed during sintering.

17. A process as claimed in claim 14 ~~or 16~~, wherein said stabilizing entities are selected from the group consisting of silicon, aluminum, zirconium, titanium, boron, germanium, chromium, vanadium, niobium and mixtures thereof.

18. A process as claimed in claim 17, wherein said hydroxyapatite substance is applied to a quartz substrate, silicon entities being released from the quartz upon sintering, into the forming calcium phosphate phases to stabilize the alpha tricalcium phosphate.

19. A process as claimed in claim 13, wherein silicon entities are added in solution to the hydroxyapatite substance before sintering.

20. A process as claimed in claim 13 ~~or 19~~, wherein said silicon entities are tetrapropyl orthosilicate.

21. A process as claimed in claim 13, wherein said calcium phosphate phases are in a ratio of 50:50 to 20:80 for the ratio of hydroxyapatite to alpha tricalcium phosphate.

22. A process as claimed in claim 13, wherein sintering of the hydroxyapatite substance is done at temperatures of about 900°C to 1100°C.

23. A sintered artificial microporous polycrystalline structure for supporting bone cell activity, said structure being made by the process of claim 13.

24. A sintered artificial microporous polycrystalline structure for supporting bone

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cell activity, said structure comprising sintered stabilized calcium phosphate phases having a globular surface morphology of loosely interconnected rounded granules with interconnected micropores in said structure.

25. A polycrystalline structure of claim 24, wherein said structure has said globular surface morphology of Figure 10.

26. A polycrystalline structure of claim 25, wherein said rounded granules have a lateral dimension in the range of 0.5 to 1μm.

27. An implantable calcified bone matrix comprising:

a) a structure for supporting said matrix;

b) a layer of stabilized calcium phosphate phases developed by the conversion of a hydroxyapatite substance in the presence of stabilizing entities at sintering temperatures into tricalcium phosphate where said stabilizing entities insolubilize and stabilize the calcium phosphate phases;

c) a boundary layer deposited by osteoblasts cultured on said layer of stabilized calcium phosphate phases; and

d) a mineralizing collagenous matrix secreted by such cultured osteoblasts.

28. An implantable calcified bone matrix of claim 27, wherein said matrix is free of bone cells including osteoblasts.

29. An implantable calcified bone matrix of claim 27, wherein said matrix includes a patients bone cells including osteoblasts.

30. An implantable calcified bone matrix of claim 27, wherein said matrix is capable of being resorbed by osteoclasts.

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31. A bulk ceramic microporous structure made with the composition of claim 1 ~~or 2~~.

32. A bulk ceramic microporous structure as claimed in claim 31, wherein said structure has an internal macroporosity.

33. An implantable device coated with the sintered composition of claim 1 ~~or 2~~.

34. An implantable device consisting essentially of the composition of claim 1.

35. A method for the culturing of functional bone cells, said method comprising

- applying a suspension of bone cells in physiological media to an artificial sintered film of stabilized calcium phosphate phases on a substrate comprising stabilized and insolubilized alpha tricalcium phosphate complexes.

36. A kit for monitoring and quantifying the activity of bone cells, said kit comprising;

- a substrate having a sintered film of calcium phosphate phases containing stabilized and insolubilized alpha tricalcium phosphate,

- a multiwell bone cell culture device adhered to said substrate.

37. A method for the *ex vivo* engineering of mineralized collagenous matrix, the method comprising the steps of:

- providing an artificial stabilized composition having a globular surface morphology of loosely interconnected rounded granules with interconnected micropores,

- applying a suspension of osteoblasts in physiological media on the composition,

- incubating the mineralized collagenous bone matrix selected by the osteoblasts from the culture; and

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- implanting the isolated collagenous bone matrix in a patient.

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